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VOL. 23, No. 9 SEPTEMBER, 1946

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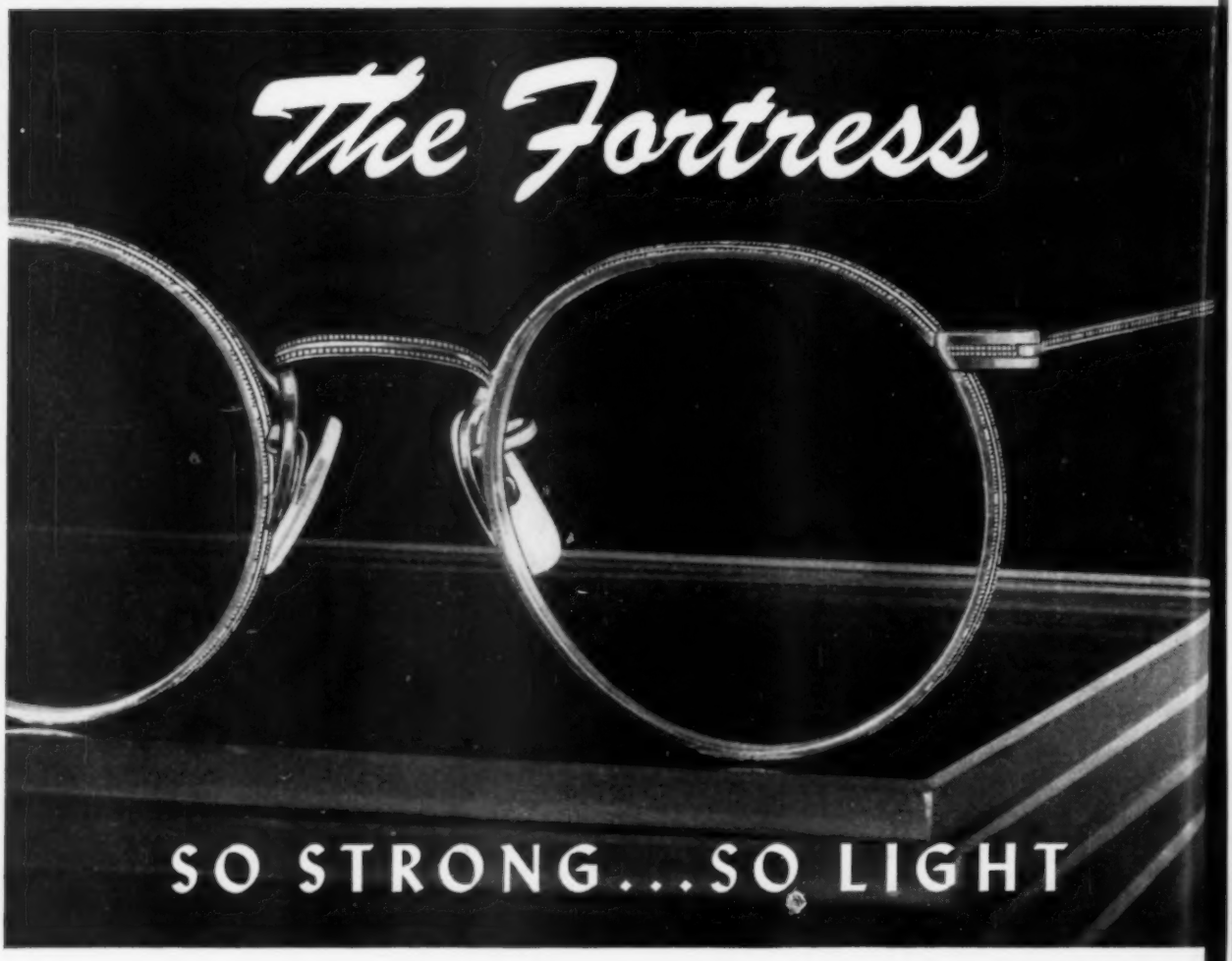
1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

ANNUAL SUBSCRIPTION $5.00 CANADA $5.50, FOREIGN $6.00
Single copies, 50c

Entered as second-class matter, February 20, 1924, at the post office at Minneapolis 2, Minnesota, under the Act of March 3, 1879.
Established 1924



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Publication Office: 1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY

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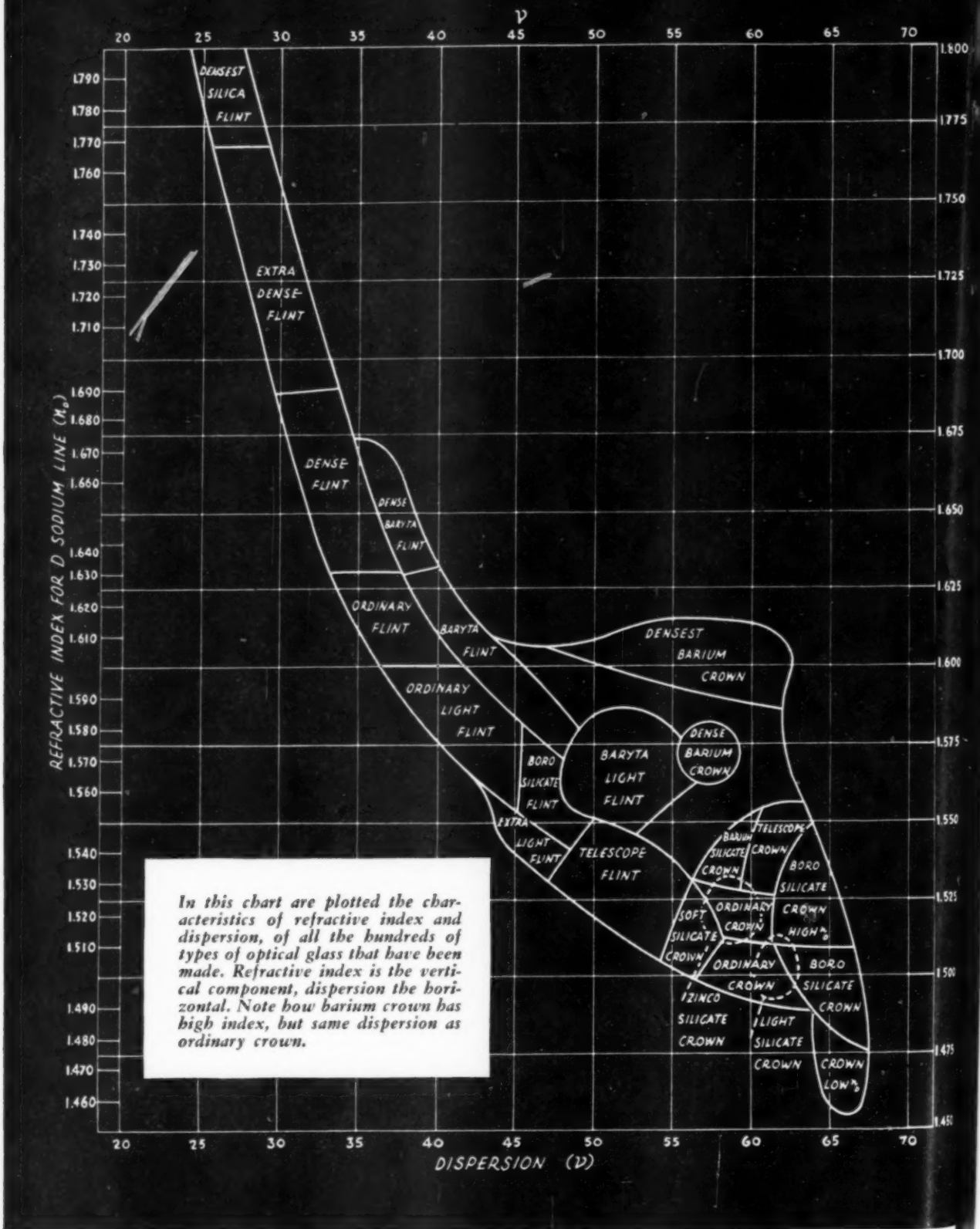

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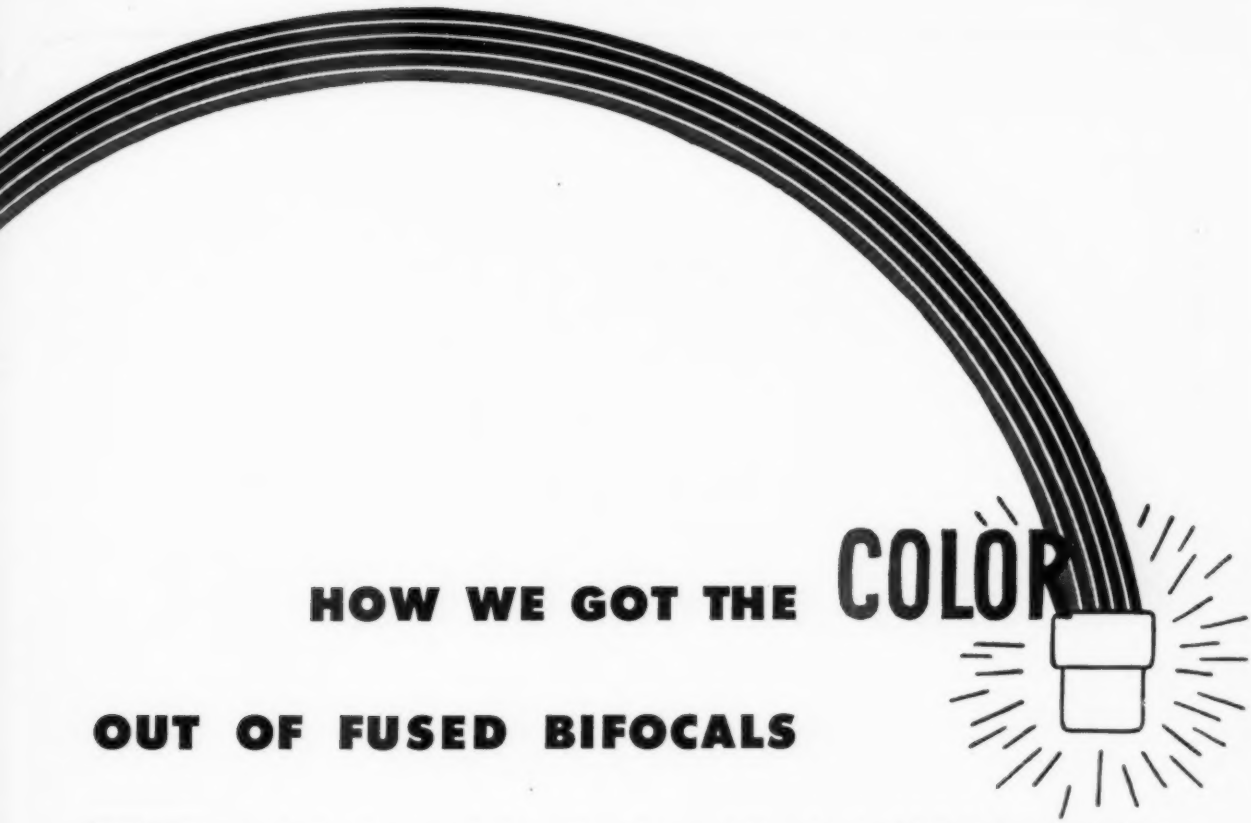

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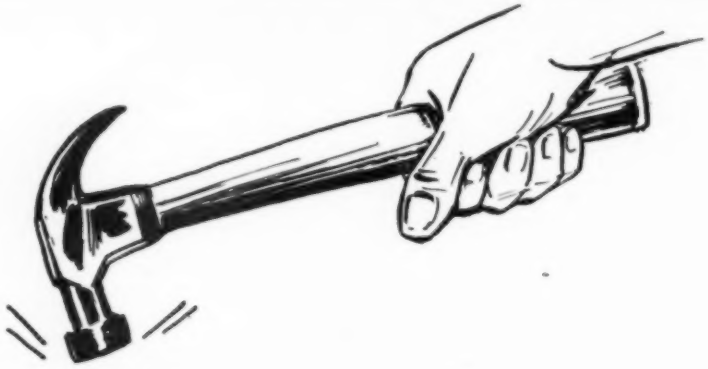

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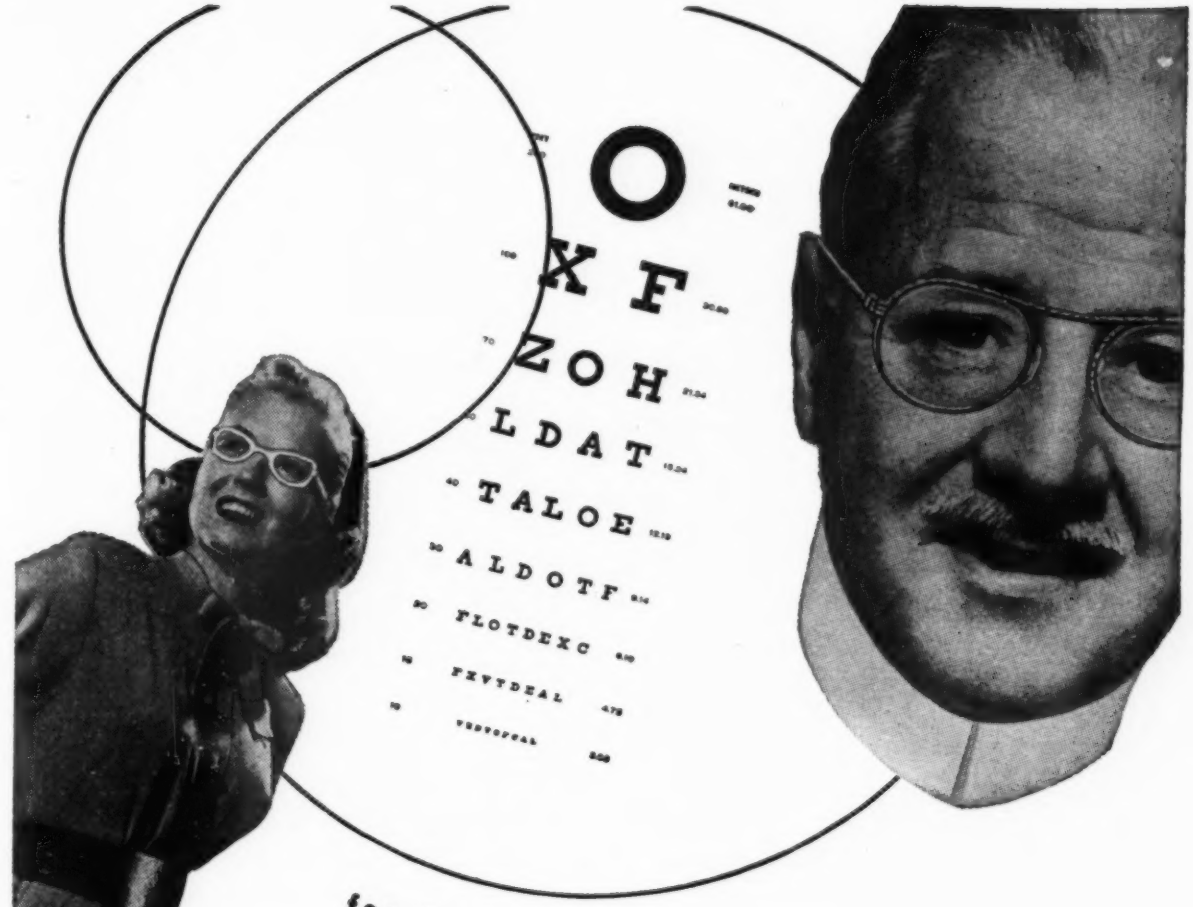

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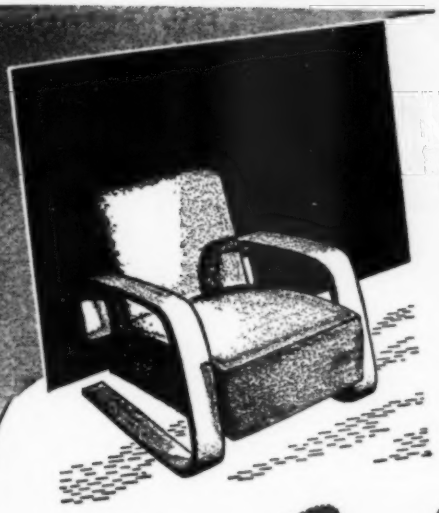

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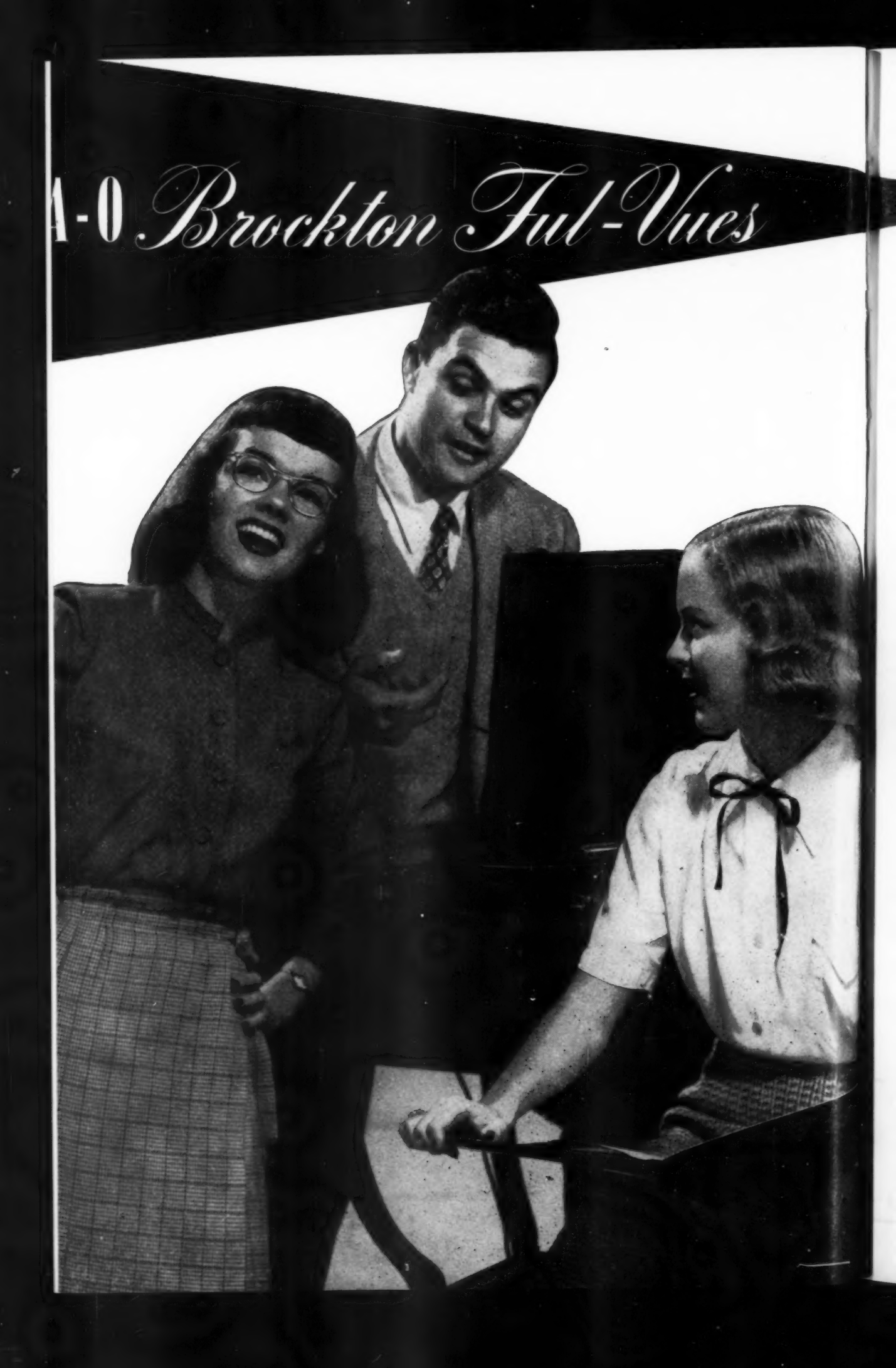
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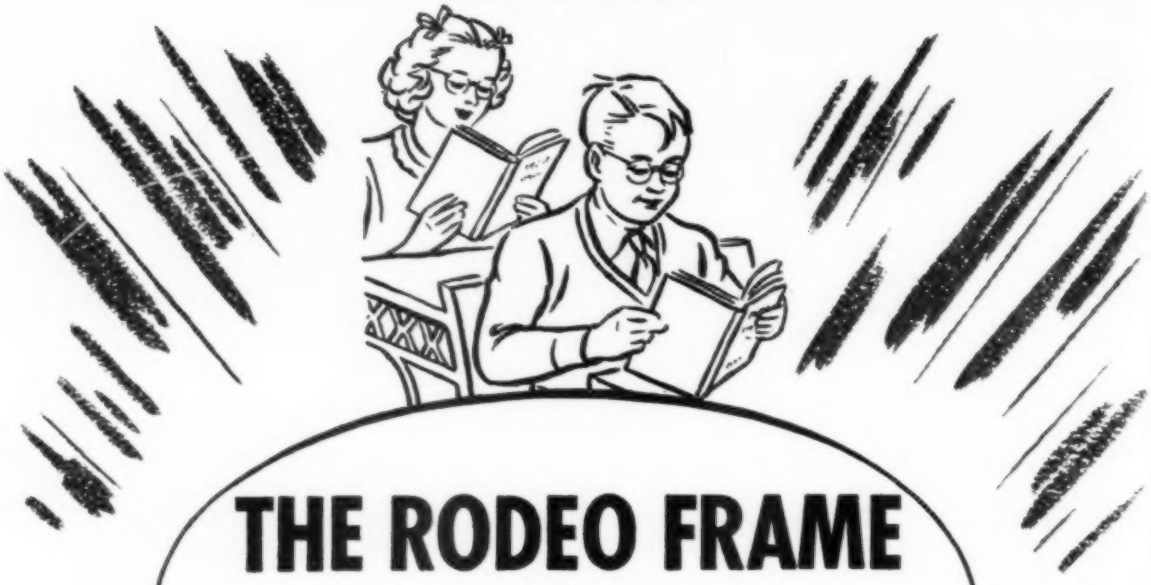

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Vol. 23 SEPTEMBER, 1946 No. 9

THE MEASUREMENT AND CORRECTION OF HYPERPHORIAS IN REFRACTIVE CASES*

Rita Walsh†
Bloomington, Illinois

INTRODUCTION

Heterophoria occurs just as frequently as ametropia, namely, in more than 80% of the cases according to Bielschowsky[1]. Vertical deviations occur less frequently than horizontal deviations, but they are just as important in any individual case. Stevens[2] says that "among the varieties of heterophoria none exerts a more disturbing or injurious influence than hyperphoria." The handling of hyperphorias in routine refractive cases is one of the hardest problems in eye examinations. In this article we shall discuss hyperphorias from a clinical standpoint: i.e., subjective symptoms, methods of measurement, therapeutic procedures and clinical findings.

TERMINOLOGY

The terminology of the hyperphorias is well known; however, we shall review some of the terms used in this discussion:

Orthophoria—is that condition in which the visual lines as well as the corresponding retinal meridians are parallel if the eyes are directed to a distant point and if the motor innervation is completely relaxed.[1]

Hyperphoria—is the tendency of one eye to deviate upward with respect to the other.

Hypophoria—is the tendency of one eye to deviate downward with respect to the other.

Hypertropia—is the manifest deviation of one eye upward with respect to the other.

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*Read before the Twenty-second Annual Meeting of the American Academy of Optometry, on December 11, 1945, at Columbus, Ohio. For publication in the September 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, Gailey Eye Clinic. Fellow of American Academy of Optometry.

Hypotropia—is the manifest deviation of one eye downward with respect to the other.

Alternate hyperphoria, double hyperphoria or dissociated vertical divergence[3]—is the phenomenon by which the non-fixating eye always turns upward. For example—such a case would show a right hyperphoria when the left eye is fixating and a left hyperphoria when the right eye is fixating.

Versions—are conjugate (or parallel) movements of the eyes; that is, both eyes are turned in the same direction. Of these we are interested in *sursumversion* by which both eyes are turned up and *deorsumversion* by which both eyes are turned down.

Vergences—are disjunctive movements of the eyes. The most important one of these is convergence. Measurements of this kind are also called ductions or amplitudes of fusion. They are the measure of the maximum deviation of one eye with respect to the other while single binocular vision is maintained. In this category we are particularly concerned with *sursumvergence* or *supravergence* which is the maximum amount that one visual line can be turned upward relative to the other. *Deorsumvergence or infravergence* is the maximum amount by which one visual line can be turned downward with respect to the other.

Other similar terms sometimes used are: *Positive vertical divergence* in which the right visual line is turned upward relative to the left. This is accomplished by introducing prisms base down before the right eye or base up before the left. *Negative vertical divergence* is that condition in which the left visual line is turned upward relative to the right. It is the amount of prism that will be accepted base up before the right eye or base down before the left while single binocular vision is maintained.

TYPES

Hyperphorias may be subdivided into various types:

1—*True or comitant hyperphoria*—in which the vertical deviation between the two eyes is constant in all directions of gaze. This is probably due not to anomalous functioning of one or more of the extrinsic muscles, but rather to mechanical or anatomical factors of positioning of the eyes in the head, etc.

2—*Paretic or non-comitant hyperphoria*—in which the hyperphoria increases or decreases in the various fields of gaze.

3—*Alternating hyperphoria*—in which the non-fixating eye always turns up. Bielschowsky ascribes this not to an anomalous position of rest of the eyes, but to intermittent excitations of the centers for

vertical divergence. Duane believes it to be due to a spasmodic contraction of the vertical muscles.

SYMPTOMS

Among the subjective symptoms of hyperphoria one can include diplopia, which may be constant or may manifest itself only after prolonged use of the eyes or general body fatigue. More common than diplopia are the symptoms of asthenopia, headaches, gastric disturbances, vertigo, blurred vision, inability to read for any length of time, etc. Often these symptoms are brought about or aggravated by situations in which the patient is required to shift his gaze frequently, as when he reads, drives, is in a crowd, etc.

The symptoms of hyperphoria do not differ characteristically from the symptoms of other ocular disturbances such as uncorrected refractive errors, lateral phorias, aniseikonia, etc. It is not possible, therefore, to diagnose any of these ocular anomalies from the symptoms alone.

MEASUREMENT

In the measurement of vertical phorias the centering of the trial frame or phoroptor is of extreme importance, especially in cases of high refractive errors and cases of anisometropia. All prismatic effect of the lenses must be eliminated before taking the measurements because a hyperphoria of as low an amount as one prism diopter may be of clinical significance. (Rule—a decentration of ten millimeters will produce the effect of a prism of one prism diopter in a one diopter lens.) Once a hyperphoria is uncovered, it might be wise to recheck the centering of the lenses to avoid error.

Determinations of the amount of hyperphoria should be repeated several times: measurements should be taken both at distance and near, and in the cardinal directions of gaze, fixating first with one eye and then with the other. Sometimes it is advisable to repeat the measurements on different days and at various times of day. An alternating hyperphoria is not infrequent. In such a case the non-fixating eye turns upward; the patient thus shows a right hyperphoria if the left eye fixates and a left hyperphoria if the right eye fixates. Obviously, a prismatic correction in such a case would be worse than none. In other cases the amount of hyperphoria measured when one eye fixates is different from the amount measured when the other eye fixates. This should also be taken into consideration before prescribing a prismatic correction for the hyperphoria.

In some cases there is a difference between the amount of hyper-

phoria at distance and at near. This might be due to the fact that the hyperphoria is of paretic origin and therefore increases or decreases in downward gaze, or it might be due to a differential prismatic effect which results from looking off center through anisometropic corrections. In such cases it is sometimes advisable to prescribe a prism of an amount comparable to the hyperphoria in downward gaze as a downward position of the eyes is much more common than an upward or straight ahead gaze.

In the measurement of hyperphorias utilizing prisms to neutralize the imbalance, the hyperphoria present is taken to be equal to the amount of prism necessary to align the images. In taking these measurements it is advisable not only to start with no prism and then increase the prismatic component gradually until the images are aligned, but also to overcorrect the hyperphoria and then reduce the prism gradually until alignment or superimposition is achieved.

It is practically impossible to achieve complete relaxation of the extrinsic eye muscles in order to determine the absolute position of rest. Bielschowsky[1] said about this: "The usual tests for heterophoria do not completely relax the fusion innervation so that the whole amount of the latent deviation becomes manifest." However, relative position of rest can be obtained by eliminating or minimizing the stimulus to fusion.[4] This can be done in various ways:

1—The most effective way of interrupting fusion is by occluding one eye. In this case only one image is received by the brain and the incentive to fuse it with another (non-existing) image from the other eye is at a minimum. It is not certain that the eyes will achieve their absolute position of rest even in this way because it is not known how long the after effects of the fusion tendency will persist after fusion has been interrupted. The prolonged occlusion test of Marlow and the screen or cover test utilize this principle in the determination of the phorias.

Prolonged occlusion test.

In 1920, Marlow[5] recommended prolonged monocular occlusion for revealing errors of muscle balance. In quite a number of cases the fusion innervation cannot be completely relaxed by quick tests that interrupt fusion in a less effective way. He found that the amount of deviation manifested would increase with the length of time of occlusion up to about one week—after which time the deviation was more or less constant. In cases of anomalous muscle balance in which the diagnosis is not conclusive it is sometimes expedient to use the prolonged occlusion

test to determine the hyperphoria. This test should be done first with one eye and then with the other, that is—one eye should be covered for one week and the phorias measured on removing the occluder; and then the other eye should be covered for one week and the phorias remeasured. Very often, the deviation will be different depending on which eye was covered.

The screen or cover test[6]—is very helpful in studying hyperphorias especially of larger amounts. The detection of low amounts of phoria (two prism diopters or under) is very difficult with this test and other tests have to be used.

The screen test is entirely objective and as such is invaluable in cases of children and unobservant patients. It is also advantageous because the interruption of binocular vision and fusion is complete and the results are apt to be less influenced by subjective factors, by the degree of binocular vision or by the individual's control on his eye muscles.

Care should be taken that the cover used in the screen test be wider than the interpupillary distance so that at no time will the two eyes be uncovered simultaneously, while the cover is switched from one eye to the other.

The subjective adjunct to the cover test is the *parallax test*. The patient is asked to report on the movement of the fixation target as the cover is switched from one eye to the other. With good observers this test is particularly helpful in cases of low amounts of phoria. Often in such cases the patient has no difficulty in judging which way the fixation target appears to move as the cover is switched from one eye to the other, while it is extremely hard to measure the low amount of phoria objectively.

2—Another way of minimizing the stimulus to fusion is by presenting dissimilar images to the two eyes. This constitutes an unusual situation so that dissociation of the eyes is achieved in most cases, although not in all. Duane,[7] in 1895, stated: "The impulse towards bringing two dissimilar images into line is almost as strong as when the images are alike." Occasionally one finds a patient who reports horizontal and vertical alignment of the dissimilar images, but who has a marked heterophoria that can be uncovered by other tests (such as the cover test). In this group of tests are included the Maddox Rod test and also tests with the haploscope, stereoscope, polarizing instruments, etc., in which a different target is presented to each eye.

Maddox Rod

The Maddox Rod test presents dissimilar images to the two eyes by distorting one of the images. The Maddox Rod consists of one or more glass rods (or high-power cylinders) mounted on a ring. A spot of light is converted into a line of light and the patient thus sees a line of light with one eye and the muscle light with the other. The eyes are therefore dissociated and will assume a relative position of rest. The two images are aligned by means of prisms, and the amount of prism necessary to bring about the alignment is taken as the amount of deviation present. In some cases, the amount of prism necessary to align the images does not correspond to the amount of deviation and sometimes will even be in the opposite direction. This is especially noticeable in cases of a manifest squint with anomalous correspondence.

The Maddox rod is one of the most convenient, easy and quick tests for hyperphoria in the majority of cases; it is invaluable as an adjunct to a routine refractive technique.

The eyes can also be dissociated by presenting a different target to each eye with the aid of an instrument such as a stereoscope, haploscope, synoptophore. The targets are dissimilar and the incentive to fusion is small. One common pair of such targets consists of a vertical line with divisions corresponding to prism diopters in one card and a horizontal line with similar divisions in the other card. When viewed through the instrument the two lines appear to cross; the point of intersection corresponds to the relative position of rest and the horizontal and vertical phoria can be read directly in prism diopters.

The measurement of the phorias by the aid of instruments has the disadvantage that there is a psychological stimulus to convergence which may vitiate the results. In cases of hyperphoria this is not so important although in some cases the hyperphoria varies with the degree of convergence used.

The measurement of phorias in the standard eikonometer is a very accurate and convenient clinical method. A cuadriculated grid or chart with gradations to indicate prism diopters is projected on the screen 20 feet away. This grid is viewed only with one eye, the other eye being occluded. A small red light in the arm of the instrument is projected straight ahead on the screen by means of a half silvered mirror in front of the occluded eye. The apparent position of the red light on the grid indicates the phoria present. Readings accurate to within ¼ prism diopter are possible with this method. Readings can be taken having either eye view the red light and variations in the amount of hyperphoria are

frequently uncovered. Complete dissociation of the images is achieved and the incentive to fusion is negligible. The test is also done at near with a different grid calibrated for 16 inches.

There are various targets that have been devised that utilize the polarization principle for the measurement of the phorias. A target is viewed that consists of two different patterns, each polarized in a different direction. The patient looks through suitable polarizing plates so that one pattern is seen with one eye and the other pattern with the other eye, thus almost complete dissociation is achieved. The polarization, of course, must be perfect, otherwise a faint shadow of the other pattern may be perceived, which is an incentive to fusion in some cases.

3—A third way of breaking fusion is by presenting an obstacle too strong to be overcome. Examples of this kind of test are the lateral diplopia test which utilizes a prism and the double image test which utilizes a red glass in front of one eye to break fusion.

Lateral Diplopia Test—Equilibrium test of Duane[7]

Another test for hyperphoria that is sometimes used is the lateral diplopia test. A suitable target—such as the 20/40 single letter E—is presented to the patient, and diplopia is achieved by introducing lateral prisms in front of the patient's eyes. If there is no hyperphoria the images are aligned horizontally. If one image is higher than the other, they are brought to a level by the use of vertical prisms. This test is inconvenient for clinical use except when the Stevens phorometer is used. In the first place, a fairly high lateral prism is required in many cases to bring about diplopia. It is preferable to use prisms base in, as the amount of prism required for breaking fusion will be less than if base out prisms are used. If diplopia is being obtained using the rotary prisms in the phoroptor one must be sure to have an equal amount of lateral prism in front of the two eyes because there is a vertical prismatic component accompanying the lateral prismatic effect in rotary prisms. By having an equal amount of prism in front of the two eyes, the vertical prismatic element will be equal in the two eyes and therefore can be disregarded. As the two rotary prisms in the phoropter are being utilized, the vertical phoria must be measured with auxiliary prisms. Another disadvantage of this method is that it is very difficult for some patients to judge the levelness of the two images that are relatively far apart.

The Stevens phorometer is a handy instrument used to measure phorias utilizing this principle. It consists of two prisms geared together and calibrated to read off the amount of phoria directly.

The double image test—can be used in some cases of manifest squint and occasionally with patients whose fusion faculty is not deeply ingrained. This test consists in viewing a muscle light with both eyes, while a red glass is held in front of one eye. This is enough to break fusion in some cases and the patient sees two distinct images, a white one seen with the uncovered eye and a red one seen with the eye that has the red glass. The relative position of the two images is indicative of the amount of phoria or tropia present. A graduated chart or grid can be made with divisions for degrees or prism diopters of deviation at a certain distance so that the amount of phoria can be readily read off the chart. The test can also be performed using a tangent screen and the location of the two lights seen can be plotted with pins in the various directions of gaze.

Ductions—Amplitudes of Fusion—

The vertical vergence tests are a set of auxiliary tests that should be done in cases of hyperphoria before prescribing a prismatic correction. These are a measure of the tolerance of the eyes to a vertical displacement of the images. They should be done both at distance and at near and can follow the lateral vergence tests. These tests consist in presenting to the patient a target with incentive to fusion (such as the 20/40 single letter E, instead of a muscle light) and noting how much vertical prism can be overcome before fusion is interrupted and the target doubles. The rotary prism is very convenient for this test because it permits one to increase the vertical prism gradually rather than by sudden steps as is the case when loose prisms are used. However, the calibrations of rotary prisms are usually in 1 or 2 prism diopter steps, and hence the readings are not very accurate when even a quarter of a prism diopter might be of significance. The speed with which the rotary prism is twirled is important and should be kept constant in any one case for both sursumvergence and deorsumvergence; all jerky movements should be avoided. The examiner should have a standard technique in this test so that successive measurements can be readily interpreted and compared.

If one tests one kind of vertical divergence immediately after the other, only a fraction of the amount of the latter will be uncovered because the artificial heterophoria produced by the prisms (by displacing the images from corresponding retinal points) does not disappear immediately after the stimulus has ceased but takes one fourth to one half hour for orthophoria to return. This can be overcome by repeating the

same test several times until a constant value is obtained. If the range of one of the fusion movements is beyond the average limits while the range of the antagonistic fusion movement is not up to normal, it is a fairly good indication that the position of rest of the eyes is in the direction of the enlarged fusion movement. A rule-of-thumb is to prescribe as much vertical prism as is required to bring the eyes to the midpoint of the vertical fusion range.

THERAPEUTIC CONSIDERATIONS

In cases of heterophorias there are three main therapeutic procedures: orthoptics, surgery and prismatic corrections. Whether one or more of these is to be used depends, of course, on the character of each particular case.

Orthoptics[8] in the field of hyperphorias is generally of limited value, being concerned mainly with increasing the range of vertical divergence with the idea that by widening the range, the patient will be able to overcome his hyperphoria with more comfort.

Surgery is used to correct hyperphorias of large amounts especially, to bring the eyes more nearly to a level. Any residual amount of hyperphoria is corrected by prism spectacles.

In the prismatic correction of hyperphoria almost all the hyperphoria can and should be corrected by the prism. This varies from the prismatic correction of lateral phorias in which only a small fraction of the total lateral phoria is corrected with prisms—(just enough so that the eyes can compensate for the rest). In the case of vertical phorias the range of vertical vergence is so small that almost all the hyperphoria needs to be corrected. It is sometimes advisable to prescribe first a small vertical prism and increase the correction gradually as the patient gets accustomed to wearing it. This might be the basis for the mistaken notion[9] that prismatic corrections should not be prescribed because they tend to increase the phoria—that is, that the patient comes back and needs more prism. The reason for this probably is that the original prismatic correction was only a part of the total vertical deviation and the patient will accept more and more help as he gets used to the correction. It is analogous to the prescription of plus lenses for hyperopia in which the plus sphere has to be increased when the patient returns as more of the latent hyperopia becomes manifest. One would not say that plus lenses should not be prescribed for hyperopia because the correction has to be increased as the patient gets used to it. Similarly, patients with heterophoria should not be denied the comfort derived

from prism spectacles because of the idea that the prisms would have to be increased on subsequent visits.

Prismatic corrections of more than 4 or 6 prism diopters are seldom prescribed because of the thickness of the lenses and because of the distortion of the images produced by the prisms.

CLINICAL REPORT

The cases used in the clinical report were selected from the refractive cases examined at the Gailey Eye Clinic in Bloomington, Illinois, in the six months between April and October, 1945. An estimate of the total number of patients refracted during this period is 2200. Of these, 165 (or 7.5% of the total) showed a hyperphoria of one half prism diopter or more and 58 or 2.6% of the total were given a vertical prismatic correction. Peter[10] reports on various statistical studies on the frequency of hyperphoria the range of which varies from 7% to 35%. It is not stated how the patients were selected nor whether the findings were with or without correction, or at distance or near.

The following tables give a statistical analysis of the clinical findings in our patients.

In table I is given the amount of hyperphoria found in the 165 cases. It is interesting to note that right hyperphoria was a little more frequent than left hyperphoria. The average amount of right hyperphoria was 2.06 prism diopters while the average amount of left hyperphoria was 2.94 prism diopters although the range was from one half prism diopter to 25 prism diopters.

TABLE I.—AMOUNT OF HYPERPHORIA

Prism Diopters	Right Hyperphoria	Left Hyperphoria
½	23	21
1	22	15
1½	7	2
2	23	9
2½	1	..
3	3	3
3½	1	3
4	6	4
5	2	2
6	1	3
7	..	..
8	3	2
9	1	..
10	..	3
Over 10	1	4
Total	94	71
Percentage	57%	43%
Average (in prism diopters)	2.06	2.54

The amount of vertical prism in the correction is presented in Table II. Here again more prisms were prescribed for right hyperphoria than for left hyperphoria (twice as many), although the average vertical prism for right hyperphoria was 1.83 prism diopters while for left hyperphoria it was 2.72 prism diopters, almost a whole prism diopter more. Out of the 165 patients with a measurable amount of hyperphoria only 58 or 35% were given vertical prism in the correction. In the 65% that had no prismatic correction are included those whose hyperphoria was too small (under 1 prism diopter), too high (over 6 or 8 prism diopters) or not consistent.

TABLE II—AMOUNT OF VERTICAL PRISM IN CORRECTION

Prism Diopters	Right Hyperphoria	Left Hyperphoria	None
½	5	2	...
1	14	3	...
1½	4	2	...
2	8	4	...
2½	1	...	...
3	1	2	...
3½	3	...	...
4	3	4	...
5	...	...	...
Over 5	1	1	...
Total	40	18	107
Percentage	24%	11%	65%
Average prism diopters	1.83	2.72	...

The age distribution of the 165 patients is given in table III. Hyperphoria does not seem to occur more frequently in any age group. From 14 to 60 years of age it seems to be equally common. The average age is 39 years.

TABLE III—AGE DISTRIBUTION OF PATIENTS WITH HYPERPHORIA

8 or under	1	35-40	14
8-10	4	40-45	8
10-12	5	45-50	12
12-14	3	50-55	20
14-16	11	55-60	13
16-18	8	60-65	4
18-20	8	65-70	1
20-25	11	over 70	4
25-30	13	not available	10
30-35	15		165

In table IV is given the amount of lateral deviation at distance, associated with the vertical deviations. One fifth or 22% had no associated lateral phoria, 32% or one third had a tendency toward divergence (25% had exophoria, 7% had exotropia) while 46% or about half had convergence tendencies (38% had esophoria, 8% had esotropia). The average exophoria or esophoria associated with hyperphoria was

TABLE IV—AMOUNT OF LATERAL DEVIATION ASSOCIATED WITH VERTICAL DEVIATIONS

Prism Diopters	Exophoria	Exotropia	Esophoria	Esotropia	Orthophoria
Under 2	15	..	21	..	..
2- 4	11	2	22	..	..
4- 6	4	..	7	..	..
6- 8	8	1	6	..	..
8-10	2	..	2	2	..
10-15	1	3	3	2	..
15-20	..	..	1	1	..
20-30	..	2	..	6	..
30-40	..	2	..	..	..
40-50	..	1	..	1	..
50-60	..	..	..	1	..
Over 60	..	..	..	1	..
Total	41	11	62	14	37
Percentage	25%	7%	38%	8%	22%
Average (in prism diopters)	3.75	20	3.79	26	..

TABLE V—AMOUNT OF REFRACTIVE ERROR IN VERTICAL MERIDIAN

(Average for both eyes)

Amount of Refractive Error	Amount of Hyperphoria in Prism Diopters: 1 or Under	1-2	2-3	3-4	4-5	Over 5	Total	Percent	Cumulative Percent
0- 0.50 D	16	3	..	3	2	2	26	15.8	15.8
0.62- 1.00	13	4	..	1	2	4	24	14.5	30.3
1.12- 1.50	8	7	4	..	1	..	20	12.1	42.4
1.62- 2.00	11	4	1	..	2	..	18	10.9	53.3
2.12- 2.50	9	4	..	1	..	3	17	10.3	63.6
2.62- 3.00	5	4	..	..	..	1	10	6.1	69.7
3.12- 3.50	6	1	..	3	..	2	12	7.3	77.0
3.62- 4.00	4	1	1	1	1	1	9	5.5	82.5
4.12- 4.50	3	2	1	..	..	1	7	4.2	86.7
4.62- 5.00	3	1	1	1	..	1	7	4.2	90.9
5.12- 6.00	2	2	..	..	..	1	5	3.0	93.9
6.12- 7.00	..	2	..	1	..	1	4	2.4	96.3
7.12- 8.00	..	2	..	..	..	..	2	1.2	97.5
8.12- 9.00	..	1	..	..	2	..	3	1.8	99.3
9.12-10.00	..	1	..	..	..	..	1	0.6	99.9
Total	80	39	8	11	10	17	165	99.9	...

3.75 prism diopters. The average exotropia was 20 prism diopters while the average esotropia was 26 prism diopters.

Table V gives the amount of refractive error in the vertical meridian in the cases that had hyperphoria. (The average refractive error for the two eyes was tabulated.) More than half of the cases (53.3%) had a correction of two diopters or less, 69.7% had a refractive error of 3 diopters or less while 82.5% had 4 diopters or less. The range of the corrections was from plano up to 10 diopters.

The amount of anisometropia in the vertical meridian is found in table VI. There were 30 isometropic patients (18%). Three quarters of the patients (76%) had an anisometropia of less than one diopter while 93% had 2 diopters or less of anisometropia.

TABLE VI—AMOUNT OF ANISOMETROPIA IN VERTICAL MERIDIAN

Hyperphoria (in Prism Diopters)	Anisometropia None	Under 1D	1.12-2D	2.12-3D	Over 3D
1 or Under	19	50	8	1	1
1-2	8	18	9	3	1
2-3	2	3	1	2	..
3-4	1	7	5	..	..
4-5	..	7	1	1	..
Over 5	..	10	5	1	1
Total	30	95	29	8	3
Cumulative %	18%	76%	93%	98%	100%

TABLE VII—VARIATION IN THE PRISMATIC CORRECTION WITH LENGTH OF WEAR OF THE VERTICAL PRISM

Hyperphoria in Prism Diopters

Visits	Same	½ Prism Incr.	½ Prism Decr.	1 Prism Incr.	1 Prism Decr.	2 Prisms Incr.	2 Prisms Decr.	3 Prisms Incr.	3 Prisms Decr.	Total Incr.	Total Decr.
Second	13	9	5	10	3	5	0	1	0	25	8
Third	4	7	3	6	7	1	1	0	0	14	11
Fourth	8	2	2	4	0	0	3	0	2	6	7
Fifth	4	0	1	5	0	1	1	0	0	6	2
Sixth	2	1	0	2	2	1	0	0	0	4	2
Seventh	2	0	1	1	0	0	0	0	0	1	1
Eighth	3	0	0	1	0	0	0	0	0	1	0
Ninth	2	0	0	0	0	0	0	0	0	0	0
Tenth	0	0	0	0	1	0	0	0	0	0	0
Total	38	19	12	29	13	8	4	1	2	57	31
Percentage of Total No. of Return Visits	30%									45%	25%

Total number of patients 46
Total number of return visits 126

In table VII an attempt was made to present the variation in the prismatic correction with the length of wear of the vertical prism. Of the 58 patients who were wearing vertical prism there were 46 who had visited the clinic more than once. The total number of return visits in this group was 126. The change in the vertical prismatic correction in subsequent visits was tabulated and it was found that in 30% of the return visits the vertical prismatic correction remained the same, in 45% the vertical prism was increased while in 25% it was decreased. Most of the changes were made in the second and third visits (68% of the increases and 61% of the decreases). In 25 out of the 46 patients included (54%) the prism was increased on the second visit.

CASE HISTORIES

1—*L. C.* Patient first seen in 1933 when 30 years old and was given just a refractive correction. She was refracted again in 1933 and was still given just a refractive correction.

R —1.00—0.75 x 15
L —0.75—2.50 x 180

In 1937 prism was first prescribed for two prism diopters of right hyperphoria.

R —1.00—0.75 x 15 = 1 B.D.
L —0.75—2.50 x 180 = 1 B.U.

Two years later (1939) the prism was increased to:

R —1.00—0.75 x 30 = 2 B.D.
L —0.75—2.50 x 180 = 1 B.U.

In 1940 the hyperphoria had increased to five prism diopters. The prescription was changed to:

R —1.00—1.00 x 32½ = 2 B.D.
L —0.75—2.50 x 180 = 2 B.U.

In 1941 the hyperphoria is slightly over five prism diopters and the correction was changed to:

R —1.00—1.00 x 40 = 2½ B.D.
L —0.75—2.50 x 180 = 2½ B.U.

In 1942 the hyperphoria was seven prism diopters. Several measurements in morning and evening disclose fairly constant findings. The new prescription was:

R —1.12—1.00 x 40 = 3½ B.D.
L —0.75—2.50 x 175 = 3½ B.U.

In late 1942 the patient was rechecked and the hyperphoria remained the same.

In 1943 the patient was examined three times at ten-day intervals. The vertical deviation was ten prism diopters of right hyperphoria on the first two visits and eight prism diopters on the third visit. The correction was not changed.

In 1944 she measured 8½ prism diopters right hyperphoria and the refractive correction was changed, the prismatic correction remaining constant.

R —0.75—1.00 x 45 = 3½ B.D.
L —0.50—2.25 x 175 = 3½ B.U.

In 1945 the hyperphoria is nine prism diopters. The new prescription has the same prism.

R —1.00—0.75 x 55 = 3½ B.D.
L —0.25—2.75 x 175 = 3½ B.U.

The patient is perfectly comfortable with the correction as is.

This case is interesting as it shows a steady increase in the hyperphoria of about one prism diopter per year for five years (1937-1942). In the last three years (since 1942) the patient has been wearing seven prism diopters of vertical prism with comfort. In this period she has been examined six times and the hyperphoria has not changed appreciably.

2—*A. C.*

Patient first seen in 1936 when 15 years of age and seen every year after that until 1940 and no hyperphoria was ever present. In November, 1941, the patient showed a left hyperphoria of 2.5 prism diopters, the refractive correction being the same as she was wearing. She was asked to return in a month when she still showed 2½ prism diopters of left hyperphoria and was given a correction of

—2.25—1.25 x 173
—1.25—1.25 x 172 = 2 B.D.

The patient returned in four months, at which time she showed a left hyperphoria of only 1½ prism diopters. The correction was not changed.

The patient returned in two years (1944) and all the hyperphoria had disappeared. The prism was removed from the correction. She returned in 1945 and she had no hyperphoria ± one half prism diopter. Today she is wearing just a refractive correction of:

—2.25—1.25 x 173
—1.50—1.25 x 173

and is perfectly comfortable.

In this case a hyperphoria of clinical significance was uncovered in a patient who had had no hyperphoria on previous visits. A vertical prismatic correction was given and worn with comfort for two years. After two years the hyperphoria had disappeared, the prismatic correction was removed and the patient is comfortable with just a refractive correction.

SUMMARY AND CONCLUSIONS

The terminology and classification of the hyperphorias are presented as an introduction to a clinical discussion of hyperphoria. The subjective symptoms are discussed and it is concluded that a hyperphoria cannot be diagnosed from the symptoms alone as these are too similar to the symptoms of other ocular anomalies.

There are three main groups of tests for the clinical measurement of hyperphorias; in all, the eyes are to achieve a position of rest by the elimination of the fusion stimulus by:

1—Occlusion. In this group are discussed the prolonged occlusion test of Marlow, the screen or cover test and the parallax test.

2—The presentation of dissimilar images to the two eyes. This principle is utilized in the Maddox rod test and in the measurement of phorias in instruments such as the stereoscope, haploscope, etc.

3—The presentation of an obstacle to fusion as in the lateral diplopia test and the double image test.

The measurement of the amplitudes of fusion or ductions is a very helpful auxiliary test.

Orthoptics, surgery and prism spectacles are discussed among the therapeutic procedures in cases of hyperphoria.

In the clinical report several tables of clinical findings are presented.

From the clinical data some interesting conclusions can be drawn:

1—The average amount of hyperphoria in cases that show a vertical deviation is between 2 and 2½ prism diopters.

2—The average amount of vertical prism given to patients in their correction is between 2 and 2¾ prism diopters.

3—There is no particular trend in the age in which hyperphoria occurs.

4—In most cases the lateral deviation associated with the vertical deviations is of low amount (65% of the cases have a lateral phoria of 4 prism diopters or less).

5—The refractive error in cases of hyperphoria is of moderate, if not of low amount. (More than half of the cases have two diopters or less of ametropia.)

6—The amount of anisometropia in cases of hyperphoria is not unusually high (76% have less than 1 diopter of anisometropia; 93% have 2 diopters of anisometropia or less).

7—There is no particular trend in the variation of the vertical prism with length of wear. In about half of the patients there is an increase in the vertical prismatic correction in subsequent visits, although the majority of these occur in the second visit. In one quarter the vertical prism remains the same in return visits, and in the other quarter the vertical prism had to be decreased.

Two illustrative case histories of patients with hyperphoria are submitted.

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DISCUSSION

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At the risk of appearing redundant or even hypocritical, I find it again necessary to use my best superlatives in describing my reaction to this paper. Doctor Walsh, with her usual thoroughness, has given us a better than excellent presentation. May I offer you, Doctor Rita Walsh, this sincere expression of appreciation in behalf of the American

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Academy of Optometry, and give you my own assurance that if the gratitude of individual members are of value to you, then your efforts have not gone unrewarded.

May I ask at this time that those of you who have questions to ask, please write them on a slip of paper and pass them up to me. At the close of my few remarks, I will select and read as many as possible for Doctor Walsh to answer.

For your information in connection with the remarks which follow I think it is proper for you to know what steps I take in my own optometric practice to detect, measure and correct hyperphoria. Hyperphoria is measured routinely in every case at twenty feet by dissociation, using the Stevens phorometer. If the result of this test is negative, no more is done, but if the result is positive then the following procedure is followed. First, lens position is carefully checked. Second, measurement by dissociation is repeated for distance and for near. Third, measurement is done by Maddox rod for distance and at near, and with the Maddox rod on first the right and then the left eye. Fourth, vertical ductions are taken using Risley prisms before the right and the left eyes. If all the data thus obtained is in good agreement and the symptoms warrant, then prisms are prescribed.

The subject of hyperphoria has aways been, and perhaps still is, an enigma to me. The measurement of hyperphoria is a very simple clinical procedure, more so perhaps, than most optometric procedures. Yet how frequently do we find that there are gross inconsistencies in our results, from day to day, or even from moment to moment. And even when all our findings are in good agreement do we not find a very irregular relationship between the degree of hyperphoria, or even the bare presence of it, and the acuteness of the symptoms? I have often prescribed a half prism diopter of vertical prism with very gratifying results, and yet in my files are the records of many cases with comparatively high degrees of vertical imbalance, uncorrected for the reason that there were no apparent complaints. I have in mind a very recent case who came to me for the very good reason that she had broken her reading glasses and could not read without them. She was fifty-three years of age and had no other complaints whatever. Her refraction was O.U. +0.25 D. Cyl. with the rule, and she required a +2.00 D. Sph. added for near. There was orthophoria for distance and an exophoria of 10△ for near. I was amazed to find 5△ of Right hyperphoria which was verified by every test at distance and at near. Upon close questioning the information was finally elicited that the patient

had suffered an accident many years ago in which a knitting needle entered the right superior orbit. There was considerable pain and diplopia immediately following the accident, but all symptoms entirely disappeared as the inflammation subsided. Needless to say, I did not prescribe vertical prism in this case.

It is extremely difficult for me to fit the phenomenon of hyperphoria into the framework of my optometric credo. My mind tries to explain all optometric phenomena in terms of structure or function or both. Yet how can we possibly explain a small constant vertical phoria in terms of either of these? What manner of functional disorder could result in a vertical displacement of the visual axes with relation to each other? And on the other hand, how can the hyperphoria be of the same value in the superior and inferior fields, if it is due to structural causes? It seems to me that hyperphoria of low amount must be of functional origin, but the phase of visual function which relates to hyperphoria is as yet outside the scope of our optometric thinking. When we have a better understanding of what hyperphoria really is, and what causes it, then perhaps we will have found a satisfying explanation of double or alternate hyperphoria (dissociated vertical divergence) and we may even find a basis for such a thing as dissociated esophoria or exophoria. .

Doctor Walsh has given us a very comprehensive resume of the methods at our disposal for the measuring and studying of hyperphoria and related phenomena. She has very capably passed on to us the results of her own large clinical experience in this important field. I am sure that if we will but follow her suggestions, we will avoid many of the pitfalls in our handling of hyperphoria.

May I again express our appreciation for this thoroughly enjoyable presentation. I know that we have all gained much that has practical everyday value for the better service of our patients.

SOME PRINCIPLES OF NOMENCLATURE*

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I

Optometry as a science is a young and vigorously growing pursuit. Its concepts are continuously being sharpened and changed by research and reflective thinking. As our science grows, new concepts are introduced, and new relationships between older concepts are discovered. Unambiguous names and precise definitions are needed for these new ideas; and the impact of these new ideas on our thinking may demand a re-examination and re-statement of some of our older concepts, or even require them to be re-named and re-defined.

The naming and defining of our optometric concepts is not an independent philosophical or logical enterprise which can be delegated to a committee on nomenclature, but is an essential part of the thinking and thus the research of the individual scientist through whose efforts the new concepts are discovered.[1]

The responsibility for supplying names and definitions for new scientific conceptions clearly falls upon the investigator whose research has introduced the new conception. Where there are two or more alternative systems of terminology for similar conceptions which have been introduced by rival investigators, it may well be left to an authoritative committee on nomenclature, such as the committee of the American Academy of Optometry, to analyze and clarify the similarities and the differences in the alternative systems. The extremely able report of the above committee entitled the "Specification of the Direction of Regard"[2] demonstrates how invaluable such an analysis may be.

The official Committee on Nomenclature should accept the term proposed by the discoverer of a new conception, unless the term is

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*Read before the Twenty-second Annual Meeting of the American Academy of Optometry, on December 9, 1945, at Columbus, Ohio. For publication in the September 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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[1]This paper incorporates certain proposals written by the author for the Committee on Nomenclature of the American Optometric Association in 1937. These proposals were modifications of more general rules laid down by Charles Peirce, the founder of American Pragnatism, in a brief paper on logic written in 1903 entitled "The Ethics of Terminology" reprinted in the "Collected Papers of Charles Peirce," Volume 2, pages 129-133, Harvard University Press, Cambridge, 1932.

clearly unsuitable; in which case the Committee should invent a suitable term for the conception, provided, of course, that the conception is worth saving. One of the major functions of the Committee should be the clarification of the meanings of terms in the light of the intentions of the original proponent of a term.

The distinctions between the meanings of similar or closely related terms should be made as precise as possible, and much of the work of the Committee might well be devoted to the clarification of the interrelationships of these terms. Where a general concept has been used in so many senses that its meaning has become vague, the Committee might well introduce new terms to designate special meanings which have been included indiscriminately under the more general term.

II

The following simple rules of procedure are suggested as a guide for those who introduce new terms into our science or who clarify the meanings of our older terms.

1. Each term should have a single meaning, unless its different meanings apply to different categories that cannot be mistaken for one another.

2. Each term should be as short and simple as possible.

3. If there are two or more different terms with the same meaning, one of these terms, in the interests of simplicity and harmony, may be selected and designated by the Committee on Nomenclature as officially preferable.

4. Definitions should be expressed strictly in accordance with the rules of formal logic.

5. Wherever possible, descriptive or factual definitions are to be preferred to those involving explanatory theories or hypotheses. The factual definition should be stated in sufficiently general terms to permit rival investigators to interpret the facts in accordance with their own theories. The general factual definition will state a function or end result rather than the theoretical explanation of the means by which it is brought about.

6. Every new optometric concept should be expressed by a new term, to be suggested preferably by the person who introduces the concept. Such new terms should be recognized and approved by the Com-

[2]Glenn A. Fry, C. L. Treleaven and R. C. Baxter. Specification of the Direction of Regard. Special Report No. 1. American Academy of Optometry Committee on Nomenclature and Standards. American Journal of Optometry and Archives of American Academy of Optometry. 22., 8., 351-360. 1945.

mittee providing the following requirements are met:

(a) The term should be constructed with due regard for the established usages of optometric, ophthalmological, and ophthalmic terminology, and those of the English language.

(b) The term should excellently fit the new concept and its meaning should be defined precisely.

(c) Neither the term itself nor its meaning should interfere with any existing term or meaning already approved by the Committee or sanctioned by general use.

III

Illustrations of the applicability of the above rules are readily found in established optometric usage. For example, a familiar violation of rule one, which requires a term to have only one meaning, is the use of the unqualified term "convergence" in several different senses. Convergence may be defined as:

(1) The entire range of disjunctive lateral movements aimed at keeping single binocular vision. The proper designation for convergence in this sense is *total convergence*.

(2) That part of the entire range of convergence in the above sense for objects of regard inside of infinity. This is correctly termed *positive convergence*, in contrast to the related term *negative convergence*, for objects beyond infinity.

Another example is the use of the term *adduction*, which may mean:

(1) The amount of prism base-out through which single binocular vision can be maintained with fixation at optical infinity.

(2) The rotation of the eye toward the nose without reference toward the other eye.

While the above senses of *adduction* are usually intelligible through their contextual relationships, this is not necessarily true of the meanings of *convergence* cited above, which are more properly distinguished by the use of appropriate qualifying terms, namely, *total*, *positive*, or *negative*.

Rule two requires a term to be as short and simple as possible. Under this rule, the term *hyperopia* would be considered more elegant than the older term *hypermetropia*, which it has replaced; and for the same reason, *astigmia* would be preferred to *astigmatism*. *Near point* and *far point* are simpler terms than their Latin equivalents, but the abbreviations "P.P" and "P.R" are still simpler, and are consequently favored.

The same is true of the abbreviations "O.D.," "O.S.," "V.," and "V.A."

Rule three suggests that an official choice be made to designate the preferred term where there are several terms with a single meaning. Examples of such terms are (a) *retinoscopy, skiametry,* and *skiascopy;* (b) *positive relative convergence, tolerance of adductive stimulation;* (c) *pseudo myopia, false myopia, college myopia,* and *industrial myopia.*

Rule four requires a definition to be expressed correctly according to the rules of formal logic. The most common violation of this rule found in optometry is for an author to explain the meaning of a term descriptively, factually, or functionally, without ever actually formulating a formal definition of the term by means of genus and differentia. The following are typical examples of this practice:

> "It will be recalled that the emmetropic eye may be defined as an eye in which the length of the eyeball bears the proper relation to the refractive power."

If we stop here, as the period indicates that we should, the definition commits the fallacy of the differentia being too inclusive. However, the author's next sentence gives us the missing qualification.

> "This relation is such that, in the unaccommodated eye, the posterior or principal focus lies on the retina. In some eyes this relationship does not exist, a condition known as ametropia (a, not; metron, measure; ops, eye). If the principal focus lies behind the retina, as in Fig. 56, H, the eye is said to be hypermetropic, or hyperopic, commonly known as far-sighted. In myopia the posterior principal focus lies in front of the retina in the static eye, Fig. 56, M. From our definition of emmetropia it is evident that ametropia is the result of one of two conditions; first, the eyeball is too short (hyperopia) or too long (myopia) : second, the eyeball is of the usual length but the refractive power of the hyperopic eye is not sufficiently great, and, that of the myopic eye is too great to bring the posterior principal focus upon the retina. This error in the refractive power is due to one of two causes; first, the curvature of one or more of the refracting surfaces is too great, as in myopia, or not sufficiently great, as in hyperopia; second, the optical density of the media is too high in case of myopia or too low in hyperopia. When the error lies in the length of the eyeball the condition is called axial myopia or hyperopia; when the refracting mechanism is at fault we have either curvature or index myopia or hyperopia."[1]

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[1]Zoethout's "Physiological Optics," Page 81.

The passage quoted above appears in an elementary text book on physiologic optics. It is obvious that such a presentation is worth very little except as a point of departure for a brilliant classroom teacher, who, like Zoethout, abhors "spoon-feeding" and is a master of the Socratic teaching method.

Rule five requires a definition to be descriptive or factual rather than to involve an explanatory theory. This rule bristles with philosophical difficulties, particularly those involved in any attempt to explain what we mean by the term "fact." As a review of these difficulties would take us far afield, we will by-pass them; and confine our consideration of rule five to its every day practical implications.

The terms "fusion," "cerebral unification," and "reciprocal replacement" have been used to designate the mental process which mediates between binocular retinal stimulation emanating from a single object, and the perception of a single image of this object. Of these, "cerebral unification" is the most descriptive and the least explanatory, and is thus preferable. A still better term would be either "sensory fusion," or the term used by Dr. Fry, "binocular integration." The unqualified term fusion not only involves explanatory implications, through the analogy of its significance in metallurgy, but it is ambiguous as well. For as we know, fusion is also more properly used to designate the neuromuscular activities which result in the conjugate rotation of the eyes and consequent binocular stimulation of corresponding areas.

The term reciprocal replacement illustrates admirably a term which itself is essentially explanatory. The term is highly useful in the context of Verhoeff's theory, but it cannot be used to replace the neutral descriptive term "binocular integration" without thereby "begging the question" as to how this process is accomplished.

We have purposely chosen an example where the theoretical explanations involved in the term under consideration, and its definition, happen to be without much doubt the most favored of our present day theories. Yet theories, no matter how well established they may be, are never timeless and immutable. Even so revered a theory as Newton's law of gravity has been superseded in a sense by Einstein's special and general principles of Relativity, since Newton's law had to be restated as a special case under Einstein's more inclusive theory of gravity. It is readily apparent, therefore, that our factual concepts should be defined in such a way as to involve as little explanatory theory as possible, so that these concepts can survive any changes in our theories.

A classic example of the importance of this rule is found in the

mutations of the meaning of the term myopia. Whether or not we agree on what myopia is, we must agree that it exists; and in order to avoid throwing out the baby with the bath when the water gets dirty, we must phrase our definition of myopia in sufficiently general terms to enable it to survive the changes which inevitably occur in our theories about this baffling concept.

Perhaps the chief difficulty in formulating a factual definition of myopia is that we no longer agree on what the facts are. The simple definition of myopia as "a condition of the static eye in which parallel rays are focused in front of the retina" is called into question by those who reject the factual status of the statement that in the myopic eye, accommodation is at rest. When myopia is defined as "the projection of near point habits," etc., we might well question the definition on the grounds that it commits the logical fallacy of using the wrong genus, or, alternatively, of violating the rule of formal logic which prohibits us from expressing a definition in figurative or metaphorical language.

And for those whose eyebrows are still raised at our temerity in criticizing a definition without quoting it in full, may we add in our defense that it is not necessary to be concerned about the rest of a definition in which the genus is rejected as being irrelevant, or is stated in metaphorical language. If, for example, we were to be offered a definition of a fountain pen which began with the statement that "a fountain pen is a flying machine that," etc., we would not have to read any further to be able to reject the proposed "definition" in accordance with the established principles of formal logic, regardless of what the rest of the statement may be..

However, let us not lose our way in the maze of enormous difficulties which make the explanation of our illustration far more formidable than our principle itself, namely, that a term or a definition should be stated as factually as possible, and should involve as little hypothesis as possible.

A more fortunate choice to illustrate this crucially important rule might have been the concept of color blindness and the various terms and definitions by means of which it has been designated.

The first term to designate color blindness was "Daltonism," after its discoverer, and it meant specifically *red-green* blindness, that is, a defect of the color sense which resulted in the confusion of red with green.

As further investigations were made, particularly those of Helmholtz and Young, color blindness was divided into red blindness, green

blindness and blue blindness, in correlation with the theory that there were three percipient elements sensitive respectively to the red, green or blue bands of the spectrum.

As the theories of the machinery of color vision were revised, corresponding changes in the nomenclature took place, until we now have a distressingly heterogeneous array of alternative nomenclatures.

Today, the only terms which do not involve hypotheses are monochromatopia, dichromatopia and trichromatopia, together with their anomalous forms. Dichromatopia has been divided into protantopia, deuteronopia, and tritanopia, and their anomalous forms; but these are essentially explanatory, as they involve the three component theory, which, while it has many strong proponents, is by no means accepted universally as the final answer in the sorely vexed field of color research.

Once again, however, our illustration is far more complex and obscure than the simple and clear principle which it is intended to clarify, and once again, we may well leave the resolution of the difficulties in the nomenclature of color to the experts in this field.

In conclusion, we wish merely to point out that while the rules and suggested procedures for validating our optometric nomenclature which were outlined in sections I and II of this paper are not offered as being exhaustive, they do have a validity of their own. This validity is independent of the illustrations which were chosen at random to throw some light on their applicability, and which express only fragments of their significance.

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A REPORT ON TWO UNUSUAL CONTACT LENS CASES*

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Case No. 1. Mr. R. age 66, a railroad passenger car conductor for many years, has had bilateral keratoconus since twenty-seven years of age. About ten years ago he developed senile cataracts of both lenses. Owing to the corneal complications most ophthalmologists were reluctant to operate but eventually one was found who was willing to undertake the operation. An extra-capsular extraction with iridectomy was performed on both eyes and recovery was uneventful. Apparently the keratoconus was unaffected by the operation. When seen by this writer some six years after the operation the patient was wearing:

O.D. +7.50 sph. ⌒ —2.00 cyl. ax. 70′
O. S. + 8.00 sph. ⌒ —9.00 cyl. ax. 165′

With this correction he read the 20/40 line on the Snellen chart with each eye but complained that he was unable to see clearly on the street or at work because of confusing aberrations.

It is interesting to note here the correction which was worn by this patient prior to the cataract extraction:

O.D. —13.00 sph. ⌒ —13.50 cyl. ax. 180′
O. S. —13.00 sph. ⌒ —12.00 cyl. ax. 180′

According to the history given by the patient he was able to pursue his duties as a passenger conductor at all times except for a period of about two months while undergoing and recuperating from the cataract operation. He admitted frankly that he was unable to read timetables, tickets, etc., and stated that he "worked" his train by having his brakeman constantly at his side to "see" for him. The periodic eye examinations given by the railroad examiners were passed by previous memorization of the test chart.

Mr. R. was referred to me to consider the possibility of contact lenses improving his vision. After several fittings with trial contact lenses it was determined that the lenses could be worn with comfort and that with them the visual acuity was O.D. 20/20-2 and O.S. 20/30-4.

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*Read before the Twenty-second Annual Meeting of the American Academy of Optometry on December 11, 1945, at Columbus, Ohio. For publication in the September 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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Because of the depth of the corneal cones and because of the irregularity in the superior limbal region due to the operative scar and also because of the high plus required to correct the aphakia it was decided to use contact lenses of the moulded all plastic type. Impressions were taken and the fitting proceeded uneventfully. When last seen the patient had been wearing his lenses for about six months; he was wearing them for periods of six hours without discomfort or blur. He reported that he is now able to perform the duties of his position without assistance and that he has passed a routine railroad eye examination without memorizing the chart.

Due to the aphakia, reading glasses were prescribed in the form of bifocals to be worn in conjunction with the contact lenses. With the contact lenses in place there was a residual astigmia of two diopters which is corrected in the bifocal spectacles.

Conclusions: The advantages of contact lenses in cases of keratoconus and in aphakia are generally recognized. We believe this to be the first recorded case in which both of these conditions were encountered and successfully corrected in the same individual. The age of this patient is interesting in that he is many years older than the oldest contact lens case previously fitted by the writer.

Case No. 2. Mr. L., age 34, a plumber, gave a history of having suffered a perforating injury to the left eye about twelve years before. As a result of the injury a traumatic cataract developed and several weeks after the accident the lens was removed. Upon recovery it was determined that vision in this eye could be brought to 20/25 with the proper aphakic correction. Vision in the unaided right eye was 20/15. Because of the monocular aphakia it was decided that it would be inadvisable to correct the left eye and the patient was dismissed. Within three years of the operation the patient developed a divergent squint of high degree in the left eye.

With the advent of World War II, this man had endeavored to enlist in various branches of the armed forces but was rejected each time because of his visual condition. He was, however, classified 1A by his selective service board and when first seen by the writer was awaiting a call for limited service in the Army. He was desirous of improving the vision in the left eye in the hope that the Army would then consider him for active duty. An ordinary ophthalmic correction had been tried but could not be tolerated because of the induced aniseikonia and the anisometropia.

A moulded all-plastic lens was fitted to the left eye which brought

the vision to 20/25 and produced a marked decrease in the divergent squint. Measured on the Stereo-Orthopter, 28 prism diopters were required to obtain superimposition of the images. Regular daily orthoptic treatments were instituted at the Clinics of The Pennsylvania State College of Optometry under the direction of Dr. Julius Neumueller. In about one week there was a further noticeable decrease in the divergence and cosmetically the eyes appeared straight. Routine treatments were interrupted by the patient being called for induction into the Army. A stereoscope and suitable cards were provided with the understanding that they were to be used in spare time at the Army camp. It was hoped that eventually true fusion would be established.

Conclusions: Boeder[1] has demonstrated mathematically the reduction of aniseikonia in aphakic eyes by the use of contact lenses. Greenspoon[2] has reported clinically on a case of monocular aphakia in which binocular vision was restored by the use of a contact lens on the aphakic eye. This case history provides a record of the second such case to be fitted successfully.

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[1]Boeder, Paul. "Power and Magnification Properties of Contact Lenses," Archives of Ophthalmology. Vol. 19, pp. 54-67, 1938.

[2]Greenspoon, Reuben. "Correction of Aphakia and Hyperphoria with a Contact Lens. A Case Report." American Journal of Optometry and Archives of American Academy of Optometry. Vol. 20, Number 1, pp. 12-13, January, 1943.

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Established 1924

Vol. 23 SEPTEMBER, 1946 No. 9

EDITORS AND STAFF

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Publication and Academy Office: 1502 Foshay Tower, 821 Marquette Ave.
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Annual Subscription, $5.00 in Advance; Canada, $5.50; Foreign, $6.00;
Single Copies, 50c.

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Published Monthly by the
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AN UPTAPPED SOURCE OF INCOME AWAITS THE GENERAL PRACTITIONER OF MEDICINE

There exists a virtually untapped source of income for the general practitioner of medicine. Its development will benefit three groups—patient, physician and optometrist. Its possibilities are worth exploring.

There are 17,264 registered optometrists. Although it is the largest profession being asked to care for the vision of America, optometry is pitifully undermanned. On the basis of the 1940 census, there is one nurse to every 770 people, one lawyer to every 730 people, one physician to every 850 people, one dentist to every 1,590 people, but only one optometrist to every 7,900 people. One optometrist to every 4,000

is desirable, which would call for 32,916 instead of 17,264 optometrists in practice.

To be unquestionably conservative we will adhere to the lower figure throughout this discussion. None the less, the physician may well keep in mind that from his viewpoint the advantages to him about to be depicted may be doubled in the near future. This is true not only because of the increase in number of optometrists likely to enter the field but also because of the better training these newcomers will have received and the greater likelihood of their uncovering and referring more cases calling for other than optometric treatment.

What bearing can this have upon medical economics?

Assuming, conservatively, that 15,000 of the present 17,264 optometrists registered are in active practice and that on the average each sees two cases a day 300 days a year, it follows that something like 9,000,000 cases undergo optometric examination annually.

If one case in a hundred presents symptoms which warrant the optometrist referring that case for other than his treatment there will be 90,000 cases annually which should be sent mostly to dentist, ophthalmologist or general practitioner.

Conceding that only a relatively small percentage of ocular pathology is of ocular origin, a reasonable estimate is that of the potential 90,000 cases 1,000 should be referred annually by the optometrist to the dentist, 9,000 to ophthalmologist or other specialist and the remaining 80,000 to the general practitioner.

What is the actual situation? The probabilities are that many more than 90,000 of the 9,000,000 cases which consult the optometrist *initially* each year should be referred. If they are not, why not?

The fault does not rest solely with optometry; medicine must shoulder its share. The dentist co-operates wholeheartedly, profitably. He is independent; he X-rays, removes offending teeth, assumes no control of the case ocularly and makes no attempt to divert the case from the optometrist who referred it.

On the other hand, the ophthalmologist co-operates only to the extent he is forced to do so, often gratuitously disparaging optometry and more or less insidiously the optometrist who sent him the case.

The experienced optometrist learns to make very definite arrangements with the best ophthalmologist available. He works with the ophthalmologist who will respect the rules of consultation; who will positively eschew refraction in the cases referred; who will respect the optometrist who compounds none but his, i.e., the optometrist's, own

prescriptions: who will treat that and only that pathologic condition for which the case is referred, and report accordingly; and who will avoid scrupulously all divertive tactics. On such a basis, carefully selected ophthalmologists have obtained thousands of dollars in fees (with no reciprocation whatever) from cases referred to them by the authors. And some have lost considerable after one slip from professional ethics or, shall we say, from common courtesy.

The experiences of many optometrists who fail to make such specific arrangements tend to lead them to rationalize referring as few cases as possible to ophthalmologists.

The observant optometrist, aware that approximately 90 per cent of ocular pathology is of systemic origin, is in a position to send most of his ocular pathologic cases to the general practitioner. But, from experience, he knows he must select with care if he is to receive aught but disparagement. He knows that the general practitioner has been propagandized to such an extent, and so indirectly, that he too automatically disparages optometry and the optometrist and then diverts the case to the ophthalmologist.

The observant optometrist is aware further that the chances are good that in most of these cases the ophthalmologist will treat, if successful will *have* to treat, the underlying systemic condition which the general practitioner did not have the acumen to recognize, or the courage to retain, as something he should have treated himself, more advantageously, economically at least to his patient, to say nothing of his own interests—professional and economic.

Now we are prepared to consider the opening question — what bearing can this have on medical economics?

In little towns and big cities all over the country there are cases which, in the interests of all involved, should be sent by some optometrist to some physician. The bulk of these cases will have presented signs of pathologic conditions—but *ocular* signs of *systemic* conditions.

The G.P. who is not averse to increasing his practice and his income, at no extra cost, may well afford to evaluate this phase of medical economics realistically.

Axiomatically the patient's welfare is of paramount importance. This stands above any loyalty the general practitioner may feel toward the ophthalmologist or any prejudice he may harbor against the optometrist. On that basis the physician should recognize the fact that the optometrist is the clearing-house through which millions of cases pass each year and that many of these consult the optometrist *initially*. This

point is crucial. Wisely or unwisely millions consult the optometrist because of some ocular or visual disturbance and, significantly, many of them are astounded, if not skeptical, when told that they require medical as well as or instead of optometrical services. There is no point to saying that many optometrists fail to do this. The point is: many *do* it and *all should*. The physician does the optometrist, himself and especially the patient a grave injustice when he fails to do his part toward cultivating the co-operation which so often means so much to so many potential sufferers.

Assuming the physician sees this point and resolves to co-operate, what bearing will it have upon his own economic welfare?

Surely he may improve his economic status with propriety if in so doing he renders valuable services to many persons who but for the optometrist would not seek his advice, would not be aware at this early stage that medical advice should be sought.

Let the G.P. estimate how many cases are likely to be sent to him for general medical treatment by all the ophthalmologists in practice, who themselves can and often do treat the systemic conditions underlying ocular manifestations.

Put against this the 80,000 cases that are likely to be sent annually to co operating physicians for general medical treatment by 15,000 optometrists who do not treat any of the systemic conditions underlying the ocular manifestations they encounter so frequently. The G.P. who faces this issue realistically will understand why so many of us classify him under Cetostomidae.

It seems odd that so much evidence is ignored which indicates that the great bulk of cases which the optometrist can refer are cases manifesting *ocular* signs of *systemic* abnormalities which rightfully belong in the hands of the general practitioner.

For example take corneal ulcers, frequently encountered by the optometrist. Does not the treatment often consist of a mydriatic only so far as the eye is concerned and a search for and treatment of the underlying causative factor? So likewise with iritis. In cases of incipient cataract, seen by the optometrist early, and with marked frequency: could not the general practitioner co-operate with the optometrist with advantage to all concerned up to the time surgical interference is in order? But, to avoid too great detail, yet to make the point, let the physician, desirous of appraising this situation economically, consider diseases of the retina alone as a sample of its potentialities. And skipping previous authorities, let him take Elwyn (1946) on this subject as his

guide. Quoting freely, we find scattered throughout the book such statements, as follows: Where the spastic contraction of retinal arteries occurs in the course of migraine, Raynaud's disease, epilepsy, brain tumor and valvular heart disease, the treatment is that of the underlying disease. Of essential arterial hypertension, he states definitely that the treatment is not in the hands of the ophthalmologist. For albuminuric and nephritic retinitis there is no treatment aside from the disease in which it occurs, which is true of diabetic retinitis also. The treatment for Sturge-Weber disease is in the hands of the neurologist and neurosurgeon. There is no treatment known for the retinal degeneration of retinitis punctata albescens. Remove all foci of infection in the teeth, tonsils and accessory sinuses in retinochoroiditis. And for syphilis of the retina antisyphilitic treatment is in order.

It should be noted that in conditions such as these the ophthalmoscope discloses to the optometrist very definite pictures of non-normal fundi. The optometrist need not diagnose the conditions which underlie these irregularities. If the fundus is not normal that case is one to be referred. And from the very nature of his practice, the optometrist becomes an expert on normal fundi and finds little difficulty in recognizing those which deviate from normal.

It should be obvious now that the physician who will co-operate on proper terms with the optometrist may see patients he might never see otherwise, see them at a more incipient stage, obtain other patients from these and increase his income in a worthy manner.

E. LE ROY RYER AND ELMER E. HOTALING

SPECIAL REPORT

THE NURSE IN AN INDUSTRIAL VISION PROGRAM*

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The importance of good vision to employees and the necessity for maintaining and protecting it on the job is a matter which should con-

*Submitted on July 10, 1946, for publication in the September 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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cern every industrial nurse. Management is more conscious of this problem today than ever before and seeks intelligent guidance both in the planning and operation of a vision program. It is possible for the industrial nurse to render a real service by acquainting management with this information.

The industrial nurse is concerned with the vision of employees because the sequelae to poor vision are poor posture, headaches, fatigue, diminished morale, inaccuracy and inefficiency, accident-proneness, and absenteeism. Visual functions bear a direct correlation to physical and mental performance on the job—to a degree, in fact, that it may be said that "eyes" rather than any other physical characteristic are hired for many jobs. Good seeing often means the difference between bodily safety and injury, or between success and failure in job performance. It therefore may mean the difference between manufacturing profit and loss.

Published studies indicate that individuals who possess fully the necessary visual ability for a job make much better operators. Their job satisfaction is greater, absenteeism is reduced, spoilage is diminished, and their health and stamina are promoted by lessened fatigue.

The National Safety Council states that $20,000,000 is the direct cost each year for injuries to the eyes, and it has been computed that the total cost of an eye injury is four times the direct cost. Estimates on bodily injuries caused by lack of proper vision run as high as $475,000,000 annually.[1] The yearly eye-caused loss in spoilage, inaccuracy, and production time can be only guessed at, but there is no doubt that it is very large.

Much of this loss to management, the employee, and the community at large can be avoided by the adoption of a systematically planned vision placement-correction-protection program. The nurse may be the first to initiate such a program and will at once find herself an essential cog in it.

The vision test administered either in the employment office or as part of the medical examination is perhaps more common in industry than any other form of employee test. Frequently the industrial nurse is called upon to assume the responsibility of giving or supervising such a test—usually a simple lettered card at a twenty-foot distance under unplanned illumination. An attempt is then made to relate the results of this test to advising the employee in respect to his visual condition, gauging visual fitness for placement, or obtaining data for compensation purposes. Unfortunately, such a test not only fails frequently to pick out workers whose vision is suited to their jobs, but actually often

selects the *less* efficient. Advice derived from this distance test alone may be arroneous and contra-indicated.

Let us consider then the act of *seeing* in its modern concepts and its industrial implications.

Seeing is a complex of physical, physiological, and psychological factors. The eye should be regarded not as an impassive camera but as a nerve ending which dynamically carries its specialized information to the back of the brain for interpretation. In this operation, visual acuity at the *workpoint* is of special significance as are depth perception, color perception, and muscle balance—all termed "visual skills" because they are learned attributes which can be more highly developed by training. Seeing is not a simple mechanical process, moreover, but a series of psychological events. Under the right techniques seeing can be measured, classified, trained, and developed.

The modern techniques employed in establishing visual standards have demonstrated beyond question that special jobs require special degrees of visual ability. Where a task is confined to a near work-distance, long range visual acuity is secondary in relation to the job at hand, but near visual acuity and muscle balance must be adequate to the job requirements. Good vision has been defined as that degree of visual functional ability which is adequate to perform the visual task presented.[1]

Recently it has become possible to classify the vision of employees and to establish reliable standards for specific jobs. These standards are based upon a statistical comparison of the employees' visual skills (e.g., visual acuity, muscle balance, depth perception, color sense) and their job performance evaluated through foremen's ratings, production, accident-proneness, or attendance.

Utilizing these standards in the employment office and in the medical examination means the securing of more capable and less accident-prone employees.

If the applicant does not meet the requirements, there are two possible dispositions: (1) assignment to a job for which he is qualified visually, or (2) referral to an ophthalmologist or optometrist for complete examination to see whether his vision can be brought up to the necessary level for the job.[8]

To meet the needs of industry, several devices have been perfected for performing rapid and reliable vision testing. The Loss Prevention Department of the Liberty Mutual Insurance Company will be pleased to answer any requests for such information.

The onset of presbyopia usually occurs between the ages of 35 and

42. Work-distances then become blur-distances to the visually unaided, and work-glasses become necessary tools. Many a presbyope will be grateful to the nurse who explains this to him and then refers him for the required professional care.

Frequently the nurse may find herself in the position to advise the employee about the use of safety-glasses. Eye hazards should be prevented at the source as far as is possible. Baffles and shields on equipment should be adopted wherever indicated. Safety-glasses, however, should be worn constantly wherever there is danger of flying particles, dust, splash, or harmful light.

Safety-glasses are obtainable either with "plano" lenses or correction lenses on prescription. It is not unreasonable that employees sometimes refuse to wear safety-glasses because they may be out of adjustment or need repair. For the continued protection of the employee the industrial nurse should be alert to the employee's attitude concerning his safety-glasses. When necessary she should refer the employee to the person in charge of their maintenance. The reduction of eye injuries through the combined forces of eye accident prevention at the source and the use of safety-glasses may be substantial.[4]

A correction suitable for specific job requirements and performance is sometimes not the same as would be provided for general use. An employee may not fully understand this point even though his doctor has explained it to him. The nurse, once again, can ease a difficult problem to the satisfaction of all concerned.

It must be realized further that the employee who works under insufficient light may be working under visual strain and with resulting fatigue. He may not see the moving parts of machinery adequately for his own safety. The nurse may make a valuable contribution by noting poor lighting conditions as they come to her attention and referring these to the proper authorities.

Often safety and health education are a natural bridge between the industrial nurse, various management departments, and the employee. The use of posters and bulletins stressing the necessity for wearing safety-glasses, the importance of coming directly to the first-aid room in the event of eye injury (no matter how slight), and the advisability of periodic eye examinations are all to the good. The nurse and the safety engineer can be an effective team.

In conclusion, an eye program in industry can be logically and broadly summarized under these headings:

1. Testing employees' visual skills.[10]

2. Proper analysis of specific job visual demands.[7]
3. Establishment of correlations between visual skills and job demands. These must be established separately for each organization.
4. Placement of applicants into jobs for which they are qualified visually as well as physically.
5. Testing employees already on the job using standards established in item 3 above.
6. Periodic rechecks of special employee groups:
   (a) presbyopes.
   (b) employees in jobs having special visual demands (e.g., very close work).
   (c) those already identified as being visually handicapped.
7. Prompt referral of employees with pathological eye conditions.
8. Referral of employees requiring refractions and prescription of corrective-protective glasses.
9. Provision of safety-glasses and goggles as well as professional fitting and subsequent servicing of such devices.[4]
10. Correct lighting through scientific planning.[6]
11. Adequate facilities for first-aid to the eye.[8]
12. Periodic check of environmental conditions.

The industrial nurse is needed to make such a program successful. Often she is the "right hand" of the medical director and can bring these facts to his attention. Not infrequently she can give such advice directly to management. She can urge the employee to become eye-conscious, to obtain periodic re-examinations and servicing of corrective-protective devices. By promoting eye-care education, the industrial nurse broadens her horizon in health and safety service.

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ANNOUNCEMENTS

CONTACT LENS INSTRUCTION WORK

Vocational training courses in contact lens fitting under the G. I. Bill of Rights have been approved for both Precision Contacts of Minneapolis and the Feinbloom Contact Lenses, Inc., of New York City. Announcement has now been made that Dr. Joseph I. Pascal of New York City has now associated himself with Dr. William Feinbloom.

Precision Contacts will hold a two-week course at Minneapolis September 16 through 28. The faculty will include Dr. Charles Sheard of the Mayo Foundation, Dr. Walter Lundberg, Associate Professor of Physiological Chemistry, University of Minnesota, and Dr. Joseph King, Associate Professor of Physiology, University of Minnesota.

Twelve three-day seminars under the direction of the technical staff of Feinbloom Contact Lenses, Inc., will be held during September, October and November in Cleveland, Milwaukee, Minneapolis, Detroit, Memphis, Parkersburg, W. Va., Pittsburgh, New York City, Toronto, Providence and Philadelphia.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news professional problems and ideals, as these relate to the Academy

ANNUAL MEETING AT PHILADELPHIA

The Annual meeting of the American Academy of Optometry will be held at the Belleveu-Stratford Hotel, Philadelphia, Pennsylvania, December 8, 9, 10 and 11. One day of the sessions will be spent on the campus of the Pennsylvania State College of Optometry.

Dr. D. G. Hummel, Chairman of the Program Committee, will announce the program of speakers during September. The Committee has already assigned most of the available program time and this Annual

meeting will again bring forth a number of original papers. The Sections on Pathology, Orthoptics, Contact lens fitting and Aniseikonia will meet with special programs in each of these fields of optometric work.

During the short business session, each of the Local Chapters will present reports of their activities for the year.

The Annual Round Table Academy Dinner will be held as usual. Dinner coats are a requirement at this Annual evening session. The arrangements for the meeting are being supervised by Dr. J. Fred Andreae, our President, and by Dr. Harold Simmerman of Woodbury, New Jersey, who now urge Fellows of the Academy to make their hotel reservations at once. Members should contact the hotel for these. Address: Belleveu-Stratford Hotel, Philadelphia, Pa.

Applicants for Fellowship who will meet with the Academy Examining Board, under the direction of Dr. Richard M. Hall, should arrive in Philadelphia on December 5, as the Board will hold its sessions on December 6 and 7.

The American Academy of Optometry Executive Council will hold a special all-day meeting on December 7.

All members of the American Academy of Optometry are expected to attend this Annual Meeting of the Academy. A program covering all events will be mailed the membership during October.

LOCAL CHAPTERS

The Vermont Chapter met at Rutland, Sunday, August 11, for an outing and regular quarterly meeting. After outdoor sports and dinner the members and four optometric guests had two papers presented. These were "Foundations of Optometry," by Dr. Robert E. Bannon of the Dartmouth Eye Institute, and "Detached Retina," by Dr. William O'Brien. According to Dr. Laurence P. Folsom, Secretary of the Chapter, several optometrists are now working on their case reports with the view of applying for Fellowship in the Academy.

CHANGE OF DATES—The dates for the Annual Meeting of the American Academy of Optometry have been changed from December 1, 2, 3 and 4, to December 8, 9, 10 and 11, 1946. The meeting will be held at the Belleveu-Stratford Hotel, Philadelphia, Pa.

ERRATUM

In the paper, Experiental Investigation of Cyclofusion, by Dr. V. J. Ellerbrock, AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY, Vol. 23, No. 8, pp. 327-341, August, 1946, Figure 3A, page 330 was reversed.

The drawing in its proper position appears below.

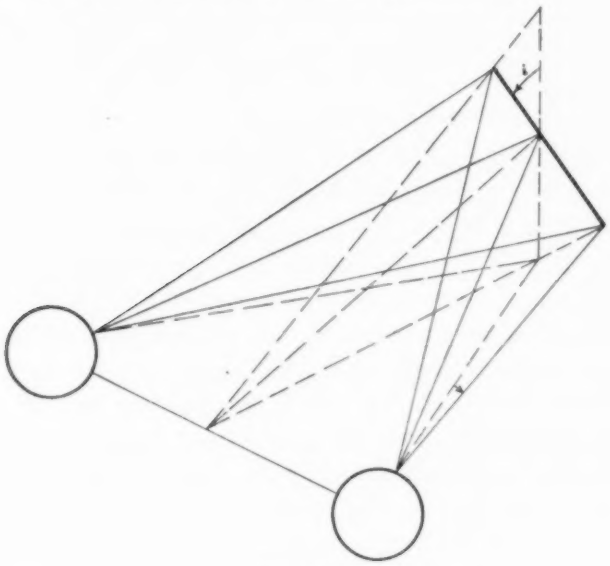

Fig. 3A

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

1. OCULAR REFRACTION

PRACTICAL AIDS IN REFRACTION. T. H. Odeneal, Eye, Ear, Nose and Throat Monthly, 1946, 25, 1, 21-24.

The author reviews a number of points known to most refractionists but towards the end of his paper comes up with the following

suggestion which is seldom seen in print and which has real value. He says, in brief, that in working on patients with lenticular opacities present, the final subjective refractive finding should be secured in a room with full daylight. The reason is obvious. The correction, if fitted in a dark room, may be unsatisfactory as soon as the patient attempts to wear it out-of-doors, as the patient's pupils will contract in bright light and thus reduce visual acuity. In the reduced illumination of the dark refracting room the patient's pupils would be enlarged and the patient might be able to see around the opacities when not able to do so under normal lighting conditions. C. C. K.

CONTACT LENS RESEARCH STILL NECESSARY. Clifford Hall, The Optician (London), 1946, 110, No. 2861, 481-482.

Hall points out that commercialism has gained a foothold in the field of fitting contact lenses in America and calls upon British optometrists to take steps to keep this from happening in England. He also feels that all optometrists should not attempt to prescribe these aids to subnormal vision. He finds it is a highly technical job requiring much time, special equipment and skill. The art is not learned quickly and the job should not be attempted unless the optometrist is very well trained. Hall observes also that the lenses themselves can still be improved and that additional work is required in this direction. He closes by suggesting the formation of a British Research Society to do some constructive work in making these techniques of greater value to the public. C. C. K.

INDUSTRY TURNING TO VISUAL SKILLS. A. E. Hicks, The Michigan Optometrist, 1946, 25, 5, 4-5.

The author reviews the work of visual care now being undertaken by management in several of the General Motors plants around Detroit. The tests include those generally referred to as visual skill tests having to do with both near and far visual acuity as well as the binocular functions of vision. A. V. H.

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2. PHYSIOLOGICAL OPTICS AND COLOR VISION

THE EFFECT OF QUALITY OF ILLUMINATION ON THE RESULTS OF THE ISHIHARA TEST. LeGrand H. Hardy, G. Rand and M. C. Rittler, Journal of the Optical Society of America, 1946, 36, 2, 86-94.

In using the Ishihara color testing charts the authors find that the

directions issued with the charts must be observed. The charts are made to be used in daylight. When artificial lighting or tungsten lamps are used the findings are erroneous. The authors point out, (1) When tungsten light is used as the illuminant, the performance scores attained by all the deuteranomalous and deuteranopic subjects tested are higher than when daylight is used. The responses of protanopic and protanomalous subjects are little affected by this change in quality of illumination. (2) A substantial number of deuteranomalous subjects are sufficiently aided in giving normal responses by the incorrect use of tungsten light to take them out of the class of color defectives when judged by performance score; that is, their scores fall within the normal limits established for daylight illumination. (3) There is a decrease in the number of cases which are correctly classified for type of red-green defect under tungsten light as compared with daylight, and an increase in the number of protanomalous and protanopic cases which are incorrectly classified. T. O. B.

SOME ASPECTS OF VISION AS A FUNCTION. I. L. Shapiro, Journal of the New York State Optometric Association, 1944, December issue, pp. 218-219.

The author reviews the functional approach to visual problems as follows: (1) Vision is a function in which the whole body participates. (2) Two separate though interrelated parts of the nervous system control the motor aspect of the function of vision: (a) Voluntary nervous system—controls the placement of a pair of eyes—the act of triangulation or convergence. (b) Automatic nervous system—controls the focusing of the eyes, referred to as accommodation. This is involuntary control. (3) The seat of efficient or insufficient control and function of a pair of eyes exists in the brain and other parts of the central nervous system. This control is referred to as the neurological pattern of visual organization. It is not located in the eyes themselves. (4) Because of the habitual relation between the use of triangulation and focus, any stimulation or inhibition to one function will tend to affect the other function in a like manner. (5) In order for a pair of eyes to function harmoniously it is necessary that an adequate "shock absorber" or "slack" exist in the central nervous system between the neurological patterns of focus and triangulation. If no such "cushion" existed, any excessive stimulation to convergence would bring about an excessive stimulation to accommodation and blurring would result. Likewise excessive stimulation to accommodation would bring about a doubling due

to reciprocal innervation to convergence. (6) A limited amount of hyperopia forms the necessary area of compensation to protect the integrity of the pattern of focus. Likewise, a limited amount of exophoria forms the necessary area of compensation to protect the integrity of the pattern of triangulation. (7) From this basic approach it is reasoned that visual problems result from disharmony between the neural pattern of control of these two functions (patterns of focus and triangulation) in the central nervous system. (8) These disharmonies are basically brought on by "reading," where "reading" is broadly defined as any maintained, sustained, concentration within a restricted area of visual activity. (9) Visual concentration in a restricted area of movement is considered an artificial task. Any artificial task will cause a "shift" or even absorption of "slack" between patterns. In the latter case symptoms of discomfort arise. Thus, discomfort is often associated with undesirable phorias; hyperopia in excess of the amount needed to protect the integrity of accommodation; dis—equilibrium between patterns; the loss of visional skills. T. O. B.

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12. MISCELLANEOUS

PRELIMINARY REPORT TO STUDY ADVANCEMENT OF OPTOMETRY IN INDIANA. Special Committee, Indiana Association of Optometrists. E. J. Cain, et al. Indiana Optometrist, 1944, 16, 7, 12-14.

The committee presents the following concepts as a basis for future study and agreement. (1) A profession has for its prime object the service it can render humanity and any remuneration or financial rewards must be a subordinate consideration. Since optometry is a profession, any individual practicing it must conduct himself in accordance with this tenet. (2) Any system of ethics and economics that seeks to distribute a profession's service on any other basis than the welfare of humanity invites the loss of that profession's right to survival. (3) There is a system of ethics and economics more than two thousand years old (slightly altered to meet contemporary conditions) by which the medical profession has survived and has been rewarded a peculiar position in society. It would be specious argument that differences in the functions of the two professions would mean that the infant profession of optometry could survive with any system of ethics and economics that varied greatly from that of medicine. (4) Because of its comparative youth and because of its origins, the profession of optometry must then lean on this heritage of medicine and base its own ethics and economics upon this historical material, altered in the light of optometry's peculiar function and not upon its peculiar origins. A. V. H.

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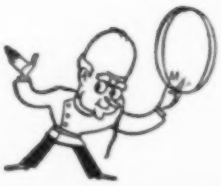

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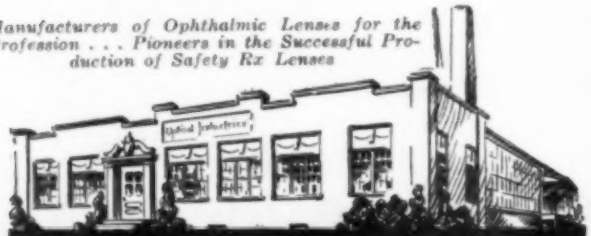

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About one-half of the space is devoted to technical articles, and the remaining half is given over to special departments, editorials, abstracts and book reviews, in large part original.

The papers and reports are original and are accepted only with the understanding that they are to be published in this journal exclusively.

The editors of the American Journal of Optometry and Archives of American Academy of Optometry beg to offer the following suggestions to authors who propose to favor them with the publication of their contributions:

I. Write on one side of the paper. Double-spaced, typewritten MS. is preferred.

II. Words to be printed in *italics* should be underscored once, in SMALL CAPS twice, and in LARGE CAPITALS three times. **Antique type** when called for should be so marked.

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